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BEFORE THE ARIZONA CORPORATION COMMISSION

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Arizona Corporation Commission

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IN THE MATTER OF THE GENERIC) DOCKET NO. E-00000A-99-0205
INVESTIGATION OF THE DEVELOPMENT OF)
A RENEWABLE PORTFOLIO STANDARD AS) TUCSON ELECTRIC POWER
A PORTION OF THE RETAIL ELECTRIC) COMPANY'S NOTICE OF FILING
COMPETITION RULES.)

Pursuant to the Commission's Procedural Order dated June 16, 1999, Tucson Electric Power Company hereby files the Direct Testimony of Thomas N. Hansen in the above-captioned matters.

RESPECTFULLY SUBMITTED this 30th day of July, 1999.

TUCSON ELECTRIC POWER COMPANY

By:

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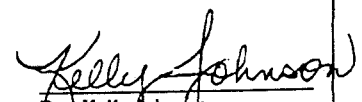
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Secretary for Brad Carroll

BEFORE THE ARIZONA CORPORATION COMMISSION

CARL J. KUNASEK

Chairman

JIM IRVIN

Commissioner

WILLIAM A. MUNDELL

Commissioner

IN THE MATTER OF THE GENERIC) DOCKET NO. E-00000A-99-0205
INVESTIGATION OF THE DEVELOPMENT OF)
A RENEWABLE PORTFOLIO STANDARD AS) **DIRECT TESTIMONY OF**
A PORTION OF THE RETAIL ELECTRIC) **THOMAS N. HANSEN**
COMPETITION RULES.)
_____)

On Behalf of
TUCSON ELECTRIC POWER COMPANY

JULY 30, 1999

1 Q. Please state your name and business address.

2 My name is Thomas N. Hansen. My business address is Tucson Electric Power Company,
3 220 West Sixth Street, Tucson, Arizona.

4 Q. By whom are you employed and in what capacity are you qualified to testify in this
5 proceeding?

6 I have been employed by Tucson Electric Power Company ("TEP" or "Company") since
7 1992, and from that time through 1994, served as Vice President, Power Production, with the
8 responsibility of managing the generation of power from TEP's generating assets. From
9 1994 through the present, I have served as Vice President and Technical Advisor to the CEO,
10 generally managing a wide spectrum of generation-related projects, including technical
11 review of our Global Solar product development program. My professional experience
12 includes the generation, transmission and distribution of electric power. I am both a
13 registered Electrical and Mechanical Engineer in the State of Arizona. My formal education
14 includes degrees in Computer Science. I am presently a Director of the Utility Photovoltaic
15 Group.

16 Q. What is the purpose of your testimony?

17 A. The purpose of my testimony is to respond on behalf of TEP to the questions set forth in the
18 Commission's Procedural Order dated June 16, 1999 in this docket and to offer some
19 modifications to the proposed renewable portfolio standard ("Portfolio Standard") rule.

20 Q. What is TEP's overall position with respect to the development of a Portfolio Standard as
21 part of the Retail Electric Competition Rules, A.A.C. R14-2-1601, *et seq.* ("Rules")?

22 A. TEP has a history of development of solar energy projects and believes that the future of
23 economic success of Tucson and Arizona will include the use of solar energy to provide a
24 sustainable energy source for the long-term benefit of Arizona. As such, the Company is
25 generally supportive of the development of a Portfolio Standard. TEP presently has solar
26 installations at Fort Huachuca, University of Arizona, a Habitat for Humanity home, two
27 portable 2 kW demonstration units used extensively for educational purposes and a fixed
28 installation at its Operating Headquarters. TEP is continuing to develop renewable resources
29 as part of its generation assets and consistent with its Integrated Resource Planning goals.
30 TEP is actively developing nearly 100 kW of additional photovoltaic sites throughout its

1 service territory, is in the final testing stage of implementing a landfill gas co-burn at one of
2 its coal fired generating units and is performing wind surveys at five Arizona locations.

3 Q. In general, what are TEP's recommendations with respect to the Portfolio Standard?

4 A. TEP is recommending a three-step process for the commencement of a Portfolio Standard in
5 Arizona. This proposal takes into consideration the requirements under the Rules for each
6 Affected Utility to become a regulated utility distribution company ("UDC") with an
7 obligation to be the provider of last resort through the provision of standard offer generation
8 service. It also takes into consideration TEP's proposed Settlement Agreement with respect
9 to stranded costs and unbundled tariffs which freezes rates through 2008, the amount of
10 dollars already funded in base rates and for UDCs and, lastly, for energy service providers
11 ("ESPs") to operate on a level playing field with respect to the obligations of fulfilling a
12 Portfolio Standard.

13 The first step would be for the Portfolio Standard for the service territory of each
14 Affected Utility to be commensurate with the funding level that exists in base rates for such
15 programs. TEP presently collects through rates about 0.025 mills per kWh for the
16 development of solar and renewable resources. This produces about \$210,000 annually for
17 the continuing renewables programs. This amount will be included in TEP's System
18 Benefits Charge ("SBC") as part of the unbundled rates. TEP proposes that it be required to
19 procure renewable generation up to the amount funded in rates for standard offer customers.
20 Competitive customers would get a credit for that amount of the SBC associated with
21 renewables (so they don't pay twice) and ESPs would be required to procure renewable
22 generation for its customers in a like amount (or pay the penalty for non-compliance).

23 The second step, through the workshop process, would be for the parties to consider
24 whether the UDC should shift dollars from demand-side management ("DSM") or other
25 programs over to the renewable resource portfolio to fund any increase in the requirement. If
26 so, the program would operate the same as the first step.

27 The third step, again through the workshop process, would consider a funding
28 mechanism for the UDC over and above what will be recommended in step two through
29 some form of renewable adder as a component of the rates for generation. If so, ESPs would
30 be required to increase their percentage as well. In the end, both standard offer and

1 competitive customers would be paying the costs of the Portfolio Standard in the generation
2 charge from their generation supplier whether it be a UDC or an ESP.

3 Q. Please respond to the questions set forth in the Commission's Procedural Order. First, should
4 there be an Environmental Standard in Arizona and why?

5 A. Arizona has an abundant supply of solar energy and should take a leadership position in the
6 development of renewable energy. Adoption of an Environmental Standard would
7 demonstrate a long-term commitment to the development of electricity from renewable
8 resources and move Arizona towards an environmentally friendly, sustainable energy system
9 for the benefit of future Arizonans.

10 Q. If so, what should be the objectives of an Environmental Standard and who should bear the
11 costs of the standard and how should these costs be collected?

12 A. The short-term objectives of an Environmental Standard should be:

- 13 • Promotion of renewable energy conversion device manufacturing facilities to be
14 constructed and operated in Arizona.
- 15 • Promotion of the installation and continued use of renewable energy conversion
16 devices in Arizona.

17 The long-term objectives of an Environmental Standard should be:

- 18 • Promotion of Arizona-based manufacturing facilities of commercially and technically
19 viable renewable energy conversion devices that provide both electrical energy and
20 capacity.
- 21 • Promotion of installation and use of renewable energy conversion systems that can
22 provide both electrical energy and capacity.
- 23 • A safe, non-polluting, sustainable energy production and delivery system of
24 reasonable cost for the residents of Arizona.

25 As all Arizonans will benefit from the cleaner environment, the reduced demand on limited
26 resources and a renewable manufacturing base, all stakeholders should contribute equally to
27 the costs. Initially, for standard offer customers, this can be through the existing funds
28 collected for renewable development. During this same time, competitive customers would
29 be required to pay the same amount per kWh as their standard offer neighbors are paying in
30 each service territory. This would keep the renewable portfolio rates the same between

1 standard offer and competitive customers. As I previously stated, after the recommendations
2 of the Solar Electricity Cost Evaluation Working Group are adopted, the funds for renewable
3 development could be derived from a reallocation of SBC between DSM and renewables
4 purposes. However, if the Commission adopts a more aggressive Portfolio Standard
5 schedule which requires funding at a level beyond that which can be derived from the SBC,
6 the Commission should consider the implementation of a renewable adder billing component
7 for all energy used in Arizona. For regulated Affected Utilities providing standard offer
8 service, the renewable adder would be in addition to the rates approved in Direct Access
9 settlements. ESPs would pass through the increased costs to their customers for the Portfolio
10 Standard as the Affected Utilities would collect from the standard offer customers in the
11 renewable adder portion of the generation charge.

12 Q. Will the proposed Portfolio Standard meet the desired objectives or would you propose an
13 alternate mechanism?

14 A. In general, the proposed Portfolio Standard provides a good framework within which the
15 desired objectives could be realized. However, we would respectfully recommend some
16 revisions to promote a more economic transition. These revisions are described herein.

17 Q. Are you supportive of the proposed Portfolio Standard and, if not, describe any modifications
18 that you would make to the proposed Portfolio Standard (including responses to 6 below) or
19 describe your Company's proposed alternative mechanism.

20 A. We are generally supportive of the proposed Portfolio Standard. However, we would
21 respectfully propose the following modifications:

- 22 • Reschedule the Solar Electricity Cost Evaluation Working Group to begin their study
23 as soon as Direct Access is implemented in Arizona and require their findings and
24 recommendations be presented to the Commission by June 30, 2000. The
25 Commission should act on the recommendations by December 31, 2000.
- 26 • Implement an initial Portfolio Standard on all electrical energy sold in Arizona, both
27 competitively and standard offer (not including existing contracts) and require that
28 money be applied to the purchase or installation of renewable energy sources as the
29 proposal now requires. Initially, for standard offer customers, this can be through the
30 existing funds collected for renewable development. During this same time,

1 competitive customers would be required to pay the same amount per kWh as their
2 standard offer neighbors are paying in each service territory. This would keep the
3 renewable portfolio rates the same between standard offer and competitive customers.

- 4 • Delay the start of any future changes in the Portfolio Standard until the Commission
5 takes action on the recommendations of the Solar Electricity Cost Evaluation
6 Working Group.
- 7 • Base the targets on cost per kWh rather than a percentage of energy sold. Thus, as
8 costs per kW fall with increasing numbers of solar installations, the kW amount of
9 renewables installed will increase, helping to further reduce costs from economies of
10 scale, creating a success spiral.
- 11 • Retain the "no earlier than January 1, 1997" installation date for defining New Solar
12 Resources.
- 13 • Extend the Early Installation Extra Credit Multiplier schedule by two years, so that a
14 full 0.5 factor would be available through 2001 to help jump start commercialization.
15 Then roll off so the last credit year with the 0.1 multiplier is 2005.
- 16 • Retain all Extra Credit Multipliers – Solar Economic Development Extra Credit
17 Multiplier (both parts), Distributed Solar Electric Generator and Solar Incentive
18 Program Extra Credit Multiplier (all 5 parts). Clarify that the maximum combined
19 Extra Credit Multiplier from these two multipliers is 1.5 for the full term of the
20 Portfolio Standard. The Early Installation Extra Credit Multiplier would bring the
21 maximum combined Extra Credit Multiplier from all three multipliers to 2.0 through
22 the year 2005. Extra credits would be used to reduce the renewable adder collected
23 from customers, so the effect would be to reduce the impact of the program on
24 customers. For example, if an Affected Utility or ESP were to sell 100,000,000 kWhs
25 of electricity, they would normally expect to collect \$2500 at 0.025 mills per kWh. If
26 the funds were used to purchase a unit built in Arizona for an Arizona residential
27 customer in 1999, the Affected Utility or ESP would qualify for an Extra Credit
28 Multiplier of 2.0, for a total credit of 3.0. The Affected Utility or ESP would then
29 only collect \$833 from the customers.

- 1 • Define a "significant investment" to qualify for the solar manufacturing facility
2 ownership credit. The credit should be extended for two years on the following
3 schedule:

4	1999	Maximum of 50% of the portfolio requirement
5	2000	Maximum of 50% of the portfolio requirement
6	2001	Maximum of 50% of the portfolio requirement
7	2002	Maximum of 50% of the portfolio requirement
8	2003	Maximum of 50% of the portfolio requirement
9	2004	Maximum of 35% of the portfolio requirement
10	2005	Maximum of 25% of the portfolio requirement
11	Beyond 2005	Maximum of 20% of the portfolio requirement

- 12 • Extend the Portfolio Standard expiration date by two years to 2014.
- 13 • Require appropriate flow and temperature metering to determine BTUs used from
14 solar water heating for purposes of calculating renewables credits.

15 Q. If you are proposing an alternative to the proposed Standard, include a detailed description
16 of: (1) technologies to be included, (2) timing, (3) any incentives, (4) cost projection of the
17 alternative over the life of the alternative, (5) impact on customer rates and (6) all major
18 assumptions for the proposed alternative.

19 A. We believe the proposed R14-2-1609 is a good framework which, with some modifications
20 recommended above, will provide incentives for development of the infrastructure to meet
21 the program objectives.

22 Q. Should the Portfolio Standard be imposed only on sales in the competitive market?

23 A. All Arizona stakeholders will benefit from the Portfolio Standard, thus all should support the
24 cost, both competitive and standard offer. However, existing contracts with customers
25 should be honored until expiration.

26 Q. Instead of implementing a Portfolio Standard as part of the Retail Electric Competition
27 Rules, should the market (the retail consumers themselves) dictate the amount of "green"
28 power to include in competitive energy sources? Should the Commission encourage ESPs to
29 offer programs, instead of mandating rigid targets, allowing the market for such products to
30 develop naturally?

- 1 A. The use of a fixed mills per kWh charge would provide an economic incentive to produce
2 more kWhs from the same dollar pool, and would provide a better incentive towards a true
3 marketplace program than the percentage of energy sold proposal. With any technologies
4 that provide social benefits at some cost (i.e., bridges, highways, dams, emergency medical
5 response, fire, police) the social benefit cost must initially be subsidized by regulatory
6 programs before reaching self-sufficiency. Arizona has much to benefit from a healthy
7 statewide solar and renewables industry.
- 8 Q. Would it be appropriate to include recovery of costs of renewable systems in a SBC rather
9 than the general cost/rate structure?
- 10 A. It would be appropriate only if all entities providing electric service in Arizona (e.g., Affected
11 Utilities, ESPs, Co-ops, public power agencies, etc.) were required to collect the SBC and use
12 it for renewable energy purchases. It would not be viable if only the Affected Utilities were
13 collecting the charge and purchasing renewable energy for the other entities. Each entity
14 providing electric services in Arizona should be responsible for their fair share of the
15 Portfolio Standard as determined by the energy they sell to Arizona customers.
- 16 Q. Please comment on the following aspects of the proposed Portfolio Standard: New section N
17 allows for "environmentally friendly renewable electricity technologies" other than solar.
18 Which technologies should be included in this subsection? Would those technologies be
19 available in Arizona or work in Arizona?
- 20 A. We recommend the following technologies be included in the definition of "environmentally
21 friendly renewable electricity technologies," all of which would be available and would work
22 in Arizona:
- 23 • Solar direct conversion to electricity, including photovoltaic technologies.
 - 24 • Solar thermal using a Rankine or Brayton thermal cycle, or any Carnot cycle derived
25 technology where solar heating provides the only source of heat to the thermal cycle.
 - 26 • Solar Sterling thermal cycle where solar heating provides the only source of heat to
27 the thermal cycle.
 - 28 • Wind electrical generation technologies.
 - 29 • Electrical storage technologies for use with the above solar and wind electrical
30 conversion technologies.

- Fueled electrical generation systems using Rankine, Brayton, Sterling or other Carnot cycle derivatives or Direct Fuel to Electricity conversion devices such as fuel cells where the fuel is derived from a product continuously and sustainably produced in Arizona and which would otherwise be deemed a waste material or otherwise has no commercial value. Natural gas, propane, methane, butane, refined petroleum products, coal and coke would be specifically excluded from being considered as a renewable fuel. Arizona-produced landfill gas, vegetative waste and agricultural by-products remaining after the separation of the salable agricultural product from the original plant would be specifically included as a renewable fuel. Future classifications of renewable fuels should be the responsibility of the Commission. Renewable fueled electricity generators would need to meet air and water quality standards set by local, state and federal regulations.

Q. In subsections A and B of the proposed Portfolio Standard, a schedule of portfolio percentages is defined. Is the size of portfolio percentage and timing of increases a reasonable strategy to be included in the competition rules? What alternatives would you propose?

A. We would recommend the Commission adopt a Portfolio Standard based on a fixed cost per kWh of electricity sold, not based on a percent of kWh energy sold formula. In this manner, the playing field between competitive and standard offer energy providers remains even, and the customers know what their renewable cost will be. A fixed percentage of energy standard does not incent the long-term reduction of renewable cost as much as one with a fixed cost factor. If a company wants to sell more product, costs must be reduced.

Q. The proposed Portfolio Standard includes incentives for in-state manufacturing and in-state installation of solar and other environmentally friendly technologies. Are those appropriate and substantial enough to have a positive impact on Arizona's economy and on Arizona economic development? What alternatives would you propose and why?

A. We believe the incentives proposed for in-state manufacturing and in-state installations are sufficient to provide incentives for the development of a healthy solar industry in the state. The proposal should help develop systems everywhere in the state, but may be very beneficial to the rural, high elevation areas not well suited for agriculture, yet receiving

1 excellent amounts of annual sunlight. We would not recommend any changes to the Extra
2 Credit Multipliers other than timing changes and application as a mills per kWh basis instead
3 of a percentage of energy sold basis as discussed earlier.

4 Q. What long-term benefits will the proposed Portfolio Standard have on the State of Arizona
5 and its residents? Specific items to be addressed include job creation, maintenance of energy
6 dollars in the local economy, load diversification, and pollution prevention.

7 A. Arizona is somewhat unique in its very high electric demands and relatively low electric load
8 factors from the need to temper the summertime heat through use of air conditioning. The
9 heat is, of course, a result of the solar radiation at a more direct angle and for longer duration
10 in the summer – ideal conditions for solar electric generators. The use of solar to electric
11 conversion devices and short-term electric storage systems will provide Arizona with a
12 supply of electric energy and demand capability less subject to cost inflation, which will
13 make Arizona products more competitive in the long term. Renewable energy development
14 will help the rural areas of the state with economic development programs using resources
15 which may otherwise have been landfilled, or from taking advantage of rural solar and wind
16 assets. As long-term coal contracts for supply from out of state reach expiration, they can be
17 replaced in part with in-state renewable resources, keeping more dollars in the state.

18 Q. What would the impact be on an average competitive (residential and commercial)
19 customer's monthly bill (assume 1,000 kWh/month usage for residential) of the proposed
20 Portfolio Standard? (Please state assumptions, including technology costs.)

21 A. Assuming no extra multiplier credits were available in 2007, and using the 1% portfolio
22 standard in the present proposal, \$5000 per kW for installed photovoltaic capacity, 10%
23 financing for 5 years, \$100 per year per kW operational and maintenance costs, and each
24 installation of 1 kW qualifies for the full \$1000 tax credit available in Arizona: The cost of
25 electricity from the renewables system would be 53 cents per kWh for the first 5 years and 5
26 cents thereafter. Blended with standard offer energy at a nominal 8 cents per kWh, the cost
27 to the consumer would be 8.44 cents per kWh, an increase of 5.5% for the first 5 years.
28 Financing over a 20-year period reduces the initial impact, but the cost remains high for a
29 longer time, and interest costs become a significant portion of what should be energy costs. I
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1 believe a price per kWh adder cap to be a better mechanism for implementing the controlled
2 development of the renewable industry in Arizona.

3 Q. Section 1609.B.2 provides for determination of a cost/benefit point in 2001 prior to an
4 increase in the percentage in 2002. Is it appropriate to determine the cost/benefits point
5 during this proceeding (and the corresponding impact on customers) or in 2001? Should the
6 Commission cap the impact that the Portfolio Standard may have on customers?

7 A. The Company would recommend creation of the Solar Electricity Cost Evaluation Working
8 Group as soon as Direct Access is implemented in Arizona and implement the initial
9 Portfolio Standard funding at the level existing now in the Affected Utilities as discussed
10 earlier, rather than delay any renewable standard for at least a year while this proceeding
11 studies the cost impact. I believe the Commission should cap the impact the Portfolio
12 Standard may have on customers, and the best method is by adopting a Portfolio Standard
13 based on a fixed cost per kWh, rather than one based on renewable energy as a percentage of
14 energy sold in Arizona.

15 Q. Section 1609.I of the proposed Portfolio Standard allows for the "banking" or sale of excess
16 solar kWh. This could create a trading program, similar to the EPA's sulfur dioxide trading
17 program. Do you have any suggestions about creating a credit trading or banking program?

18 A. The adoption of a Portfolio Standard based on a mills per kWh renewable adder would not
19 require a credit banking program. The benefits of extra credits would flow to the customers
20 immediately as an increase in systems benefit funds for DSM and low income program
21 support for standard offer customers and in rates for competitive energy customers. I would
22 propose that the program should require annual reports submitted to the Commission by all
23 electric energy providers in Arizona for review and audit. The report should also include an
24 accounting for the funds collected under the Portfolio Standard, and the renewable energy
25 thus generated.

26 Q. Section 1609.F provides for penalties if ESPs fail to meet the proposed Portfolio Standard.
27 Are there additional provisions needed to require ESPs to issue requests for proposal or
28 negotiate contracts in a timely fashion rather than merely pay the penalty?

29 A. TEP's recommendation is to implement the Portfolio Standard with a fixed cost per kWh
30 renewables charge on all competitive and standard offer energy sold in Arizona, not

1 including energy sold under existing contracts. The proposed penalty is based on not
2 purchasing sufficient kWhs of renewable energy, and would not apply under our
3 recommendations. The Affected Utility, ESP or other energy providing entity in Arizona
4 would individually collect funds under the Portfolio Standard and annually demonstrate to
5 the Commission their use of those funds to purchase renewable energy or develop renewable
6 generation resources. If an energy provider failed to use the required Portfolio Standard
7 funds to purchase renewable energy or systems, as determined from Commission review and
8 audit of the annual Portfolio Standard report, the errant provider would be required to remit
9 the difference to the Commission, times a penalty multiplier. These funds would be used for
10 the same purposes presently proposed for use of penalty funds in the proposed Portfolio
11 Standard.

12 Q. Should the proposed Portfolio Standard or any alternative that you are proposing apply to
13 standard offer customers in 2001? If yes, should the standard or the alternative as applied to
14 standard offer be energy driven (kWh) or dollar driven to limit or cap the impact on standard
15 offer customers? What would the impact be on an average residential and commercial
16 customer's monthly bill? (Please state assumptions, including technology costs.) What
17 mechanism should the Commission put in place to recover the cost from standard offer
18 customers?

19 A. The Portfolio Standard should apply to all energy sold in Arizona, except that sold under an
20 existing contract, including both standard offer and competitive energy. The Portfolio
21 Standard should be dollar driven to limit the impact on standard offer customers as described
22 earlier as a part of the SBC. At the level of 0.025 mills per kWh, the impact would be less
23 than 0.1%. For a typical 1000 kWh per month consumer, a charge of 0.025 mills per kWh
24 would result in an increased cost of 2.5 cents per month, or 30 cents per year. For a
25 commercial customer with an annual peak demand of 150 kW – McDonalds in summer – and
26 a 60% capacity factor in summer would expect to pay an additional \$1.65 for the month. The
27 charge would be insensitive to the technology used, another advantage of making the
28 Portfolio Standard dollar driven.

29 Q. Other relevant comments?
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1 A. Arizona has a widely distributed, abundant solar resource, a sizable agricultural industry
2 producing continuous waste streams of energy rich plant matter and some sites suitable for
3 wind to energy development projects. The adoption of a Portfolio Standard with
4 economically reasonable impact should lead to the development of a renewable industry
5 within Arizona that will tap the renewable energy resources currently unused. It should also
6 develop a manufacturing base to further diversify Arizona's economic base.

7 Q. Does this conclude your direct testimony?

8 A. Yes.
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